Title: On The Go!

Brief Overview:

This unit uses transportation as a theme to help students understand how to collect and display data in tables and bar graphs. The students will gather information in a variety of ways (survey, sorting, and investigations). The students will use the information to create tables and bar graphs. Using the organized information gathered, the students will interpret and make predictions based on the data.

NCTM Content Standard:

Students will sort and classify objects according to their attributes and organize data about the objects.

Students will collect data using observations, surveys, and experiments.

Students will represent data using tables and bar graphs.

Students will make inferences and predictions based data.

Grade/Level:

$2^{nd}/3^{rd}$ grade

Duration/Length:

Three 60-minute lessons

Student Outcomes:

Students will:

- Sort and organize data according to attributes
- Record data in order to create a bar graph
- Interpret data from a bar graph
- Interpret data from a bar graph to answer questions
- Use a bar graph to make accurate predictions that they can support

Materials and Resources:

- (3)100 ml graduated cylinders
- Classroom supply of 10 ml medication syringes (can get donated from doctor's office or pharmacy)

- Toy car, truck and plane (can also use dye cuts)
- Food coloring
- Water
- Crayons or markers
- Bags with random number of toy cars, trains, and planes. Bags should have varied number of toys (all bags should contain at least 2 but no more than 10 of each toy). You will need enough bags for each group of 4 students.
- Pull back cars (1 for each group of 4 students)
- Measuring tape
- Ruler
- Clip board

Development/Procedures:

Day 1

Pre-assessment

- Distribute one copy of Pre- Assessment (Student PreAssessment) to each student.
- Students will identify a part of the graph and answer questions by interpreting data from the graph.

Engagement

- Display (3) 100 ml graduated cylinders in front of the class. Each cylinder should have several drops of food coloring in the bottom. Place a car, truck, and plane in front of each cylinder.
- Give each student a syringe with 5 ml of water
- Ask the students to vote for their favorite vehicle by placing the water into the corresponding cylinder.

Exploration

- Have the students talk to a partner about what the filled graduated cylinders looks like. What do the 3 cylinders remind you of?
- Have students share ideas with the class.
- Discuss what students know about a bar graph
- Talk about how adding water to each of the graduated cylinders they were collecting data.
- Discuss how the use of cylinders helped organize the data much like a bar graph organizes data.
- Talk about why they might want to collect data. Discuss the idea that there should be a purpose for data collection. Why might we want to know the favorite type of transportation for the class? Allow students to share their thoughts.
- Ask, “Why did you want to organize the data we collected?” (makes it easier to read and interpret)

Explanation

- Distribute a copy of student resource, Student_Favorite Vehicle Graph
- Display a large copy of Student_Favorite Vehicle Graph
- With the class construct a bar graph using the data from the cylinders and the Student_Favorite Vehicle Graph. Students will follow along as you guide them through the steps, use the bar graph vocabulary such as title, axis, information, labels and scale. After graphs have been created, have a class discussion interpreting and analyzing the data.
    - What means of transportation does the class like the most? the least?
    - How many more people like _____ than _____?
    - Did the class like any transportation equally?
    - How do you think our graph could change if a group of 20 farmers walked in the room and voted? a group of 20 race car drivers? a group of 20 world travelers? Why?
- Cut out vocabulary cards from Student TAILS Vocab Cards
- Display the vocabulary cards
- Ask the students to use the cards to label the completed large Students' FavoriteVehicleGraph.
- Talk about the parts they should label and how it is important to the graph.
- Discuss why it is important to incorporate all 5 parts of the graph.

Extension

- Ask the students, "Who likes to fly kites?"
- Have the students take turns drawing pictures of kites on the board.
- Circle the tail of the kite in the drawings. Does anyone know what this is called? Share answers.
- Talk about how kites are similar to graphs in that they both have parts. We are going to use the kite tail to help us remember the parts of a graph.
- Distribute TAILS explanation resource.
- Discuss what the acronym TAILS stands for. Go over the vocabulary.
- Take the vocabulary cards from the large graph. Start with the T (Title) and place each label part in order spelling out the word TAILS.

Differentiation

- Reteach
    - Distribute Student SmallTAILSVocab Cards. Allow students to independtly label their individually completed Students' FavoriteVehicleGraph.
    - Check for understanding.

- Enrich
    - The students will modify the graph created in class. The student will choose a scenario of adding 10 more pieces of data by surveying farmers that walked in the room. How do you think the farmers will vote? How did the graph change? Why did you choose the data that you did?
    - Collecting data in a frequency table. http://www.bbc.co.uk/education/mathsfile/shockwave/games/datapick.html

- Graphing vocabulary website
  http://www.mhschool.com/math/2003/student/crossword/puzzles/gr5_ch8.html

Evaluation

- Distribute Student labeling assessment and have students complete it independently. An answer key is provided.

Day 2

Engagement

- Tell: My family has decided to have a family reunion at my Uncle Bob's house on the west coast. Since most of our family lives on the east coast, we have decided to make travel plans together. I have volunteered to organize the trip to the west coast. In order to make as many people happy, I have decided to survey my family as to whether they would like to travel by car, plane, or train. All my family members have gotten back to me and now I am ready to make a decision. I need your help today reading the data so that I can book our transportation. I am going to give you a data sheet. Don't look at it until I tell you.
- Divide the class in half by giving half the students the Student Family reunion bar graph and the other half of the class gets the pictures of pictures of cars, trains, and planes, Student_FamilyReunionUncategorized. Don't let on that you are dividing the room in half.
- Ask: How many people want to travel by plane?
- Ask: How many people want to travel by car?
- Ask: How many more people wanted to travel by plane than train?
- Half the class will be slower to answer questions.
- Say: Wow, some of you are still asleep. I have my gifted students on this side of the room. What is wrong with the rest of you?
- Reveal both graphs
- Talk about why it is important to organize and display data in a graphic way.

Exploration

- Divide students into groups of 4. Heterogeneously group students so that students with stronger knowledge of graphs are paired with students who may have a weaker understanding of bar graphs.
- Give each group a bag of transportation toys and each student will need their own copy of Student Transportation Bag Cooperative GraphWork page. There will be cars, trains, and airplanes in each bag. Each bag will be different.
- Instruct the groups to take one mystery bag per group. The students will sort the types of transportation toys, count them and then graph their data as a group.

Explanation

- Have each group discuss what they found in their mystery bags. Display their graphs and share why they organized their data the way they did.

- Ask groups about their scale, title and labels
- Ask students to describe their data.

Extension
- Question students to check for understanding

Differentiation
- Reteach
    - Distribute Student_TransportationBagCooperativeGraphWorkModified
    - Pair lower level students with higher level students

- Enrich
    - Reading bar graphs website. http://www.scienceacademy.com/BI/
    - On construction paper, design your favorite means of transportation and write about it.

Evaluation (Ongoing formative assessment for Day 2)
- Distribute copies of Student Ways Our Class Gets to School to each student.
- Students will work on interpreting data. An answer key is provided.

Day 3

Engagement
- Students watch a video clip of NASCAR race http://www.nascar.com/video/post-race/final-laps/110508/cup-dar-high-final/.

Exploration
- After viewing the video, a discussion will begin regarding the quality of the racetrack and why that is important to racing.
- Questions posed might be…Which track surface would allow cars to go the fastest? Which track surface might create more friction causing cars to go slower?
- Students will be conducting a test in groups of four. Students will use a Student Data Sheet with a clipboard, a pull back toy car, a ruler , and measuring tape to collect their own data to test which road surface the toy pull back car will travel the fartherest.

Explanation
- Before students begin collecting data, explain how to conduct the experiment and record the data using Teacher Data Sheet
- Explain that the group will have to agree on three surfaces that they will test with the pull back car and write those surfaces on their data sheet. Use the Teacher Data Sheet as a model for this.

- Model to students how once you choose the three surfaces, bring materials to one of the surfaces. Show students how carpet was the first one on your example.
- Demonstrate how to run the experiment on the carpet. Lay the ruler down and tell students the pullback toy car will begin on the 1 inch mark of the ruler and then the pullback toy car will get pulled back to the 12 inch mark of the ruler and released on the carpet.
- Once the car has come to a stop, show students how to use a measuring tape to measure how far the car went, measuring form the 12 inch mark of the ruler where the car was released to the point the car stopped. Next, demonstrate how to record that data under the Amount Car Travelled portion of the table on their data sheets.
- Continue to demonstrate how to conduct the experiment and record data for the remaining surfaces of tile and blacktop
- Each student will be given their clipboards, a pencil, and his/her own individual data sheets. Students will be divided into groups of 4 where they will have a bucket filled with the materials they will need for their experiment. Each bucket will contain 1 pull back toy car, a ruler, and measuring tape.
- Students will conduct experiments and collect data on Student_DataSheet at this time.
- When students complete data sheets, demonstrate how to take the data recorded and make a bar graph to compare the distances traveled on the various track surfaces.
- Use Teacher DataSheet to demonstrate how to put information collected step by step onto a graph. Identify the components of a graph (Title, Axis, Information, Labels, and Scale) using Teacher Data Sheet Graph.

Extension

- Give students Student_DataSheetGraph to create graphs from their own data that they collected.

Differentiation

- Reteach students who have not presented skill mastery.
  - Using a Student_DataSheetDifferentiation and Student_DataSheetGraphDifferentiation, students will graph a mock simulation with step by step teacher guidance.

- Enrich
  - In pairs or individually, students will be given a blank data table sheet (Student_DataSheetEnrich), dice, and a piece of graph paper to conduct an experiment. The scenario will be that students will pretend that they are trying to purchase a car. Using the data sheet, each student will roll the dice three times. With each roll, students will record the two digits in the ones and tens place to produce a digit that will serve as the mock miles per gallon each car uses. Students will then take the information from the completed data table to create a graph making sure to include Title, Axis, Information, Labels, and Scale.

- Students will use completed data sheet table and graph to decide which car they would buy and why. Students will provide reasoning to support their decision from the information collected.

Evaluation

- Collect students' completed graphs and data sheets. Conference with each student about their progress with completing the graph and adjust any errors. Ask questions, and compliment their effort to confirm skill mastery.

Summative Assessment:

- Students will be given Student Summative Assessment which will provide a scenario in which students must use a completed data table to construct a bar graph. The graph will detail which race car driver has gone the furthest or greatest amount of laps around the racetrack. After completing the graph, students must provide answers to multiple choice and short answer questions related to the graph. An answer key is provided.

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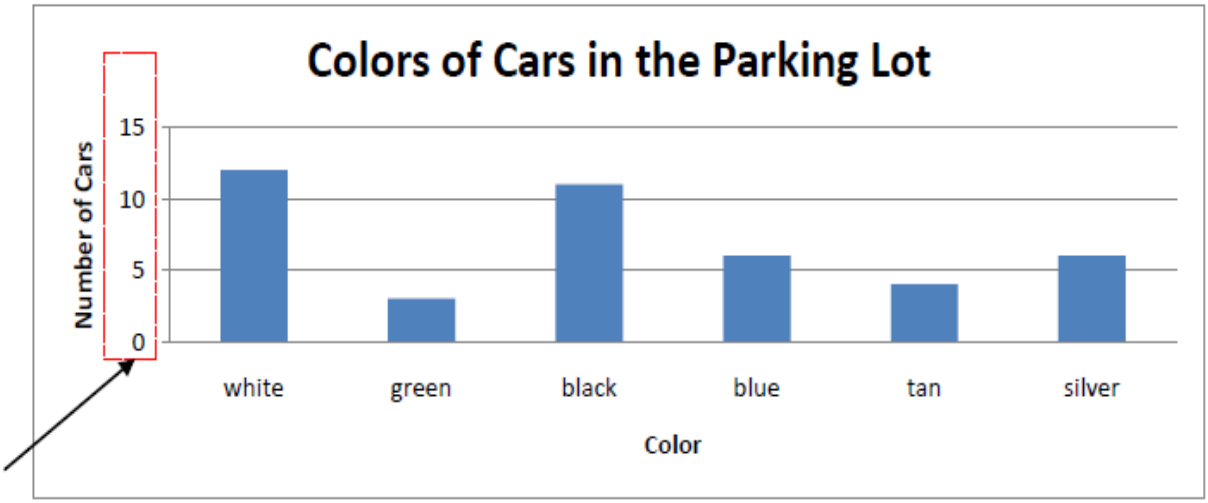
Pre- Assessment

Name_____



1. Look at the arrow and box on the graph above. What part of the graph is it?
    a. Title
    b. Label
    c. Scale

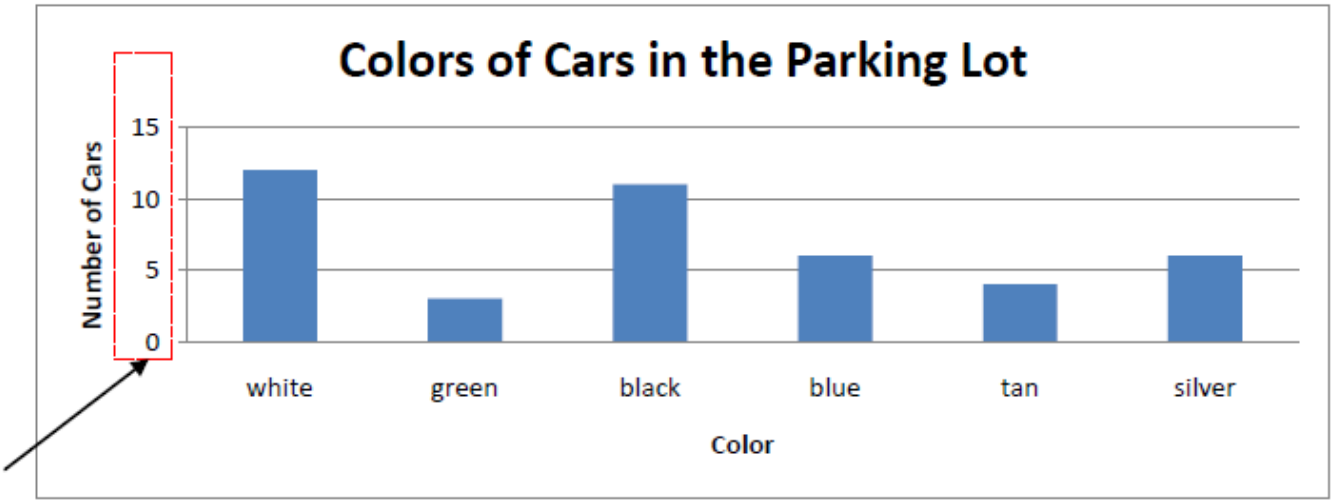
2. Using the graph above, what color was the least amount of cars?
    a. tan
    b. white
    c. green

3. Write an equation in the box below about the graph above using <, >, or =. (Example: black = blue)

_____ _____ _____

Pre- Assessment

Name_____



1. Look at the arrow and box on the graph above. What part of the graph is it?
   a. Title
   b. Label
   c. Scale

2. Using the graph above, what color was the least amount of cars?
   a. tan
   b. white
   c. green

3. Write an equation in the box below about the graph above using <, >, or =. (Example: black = blue)

Answers May Vary

_____ _____ _____

STUDENT FAVORITE VEHICLE GRAPH

Name_____

Directions: Observe and measure the water levels that your class created when they voted for a favorite vehicle. Create a bar graph that details the results.

Cars

Title

Label

Label

Label

Label

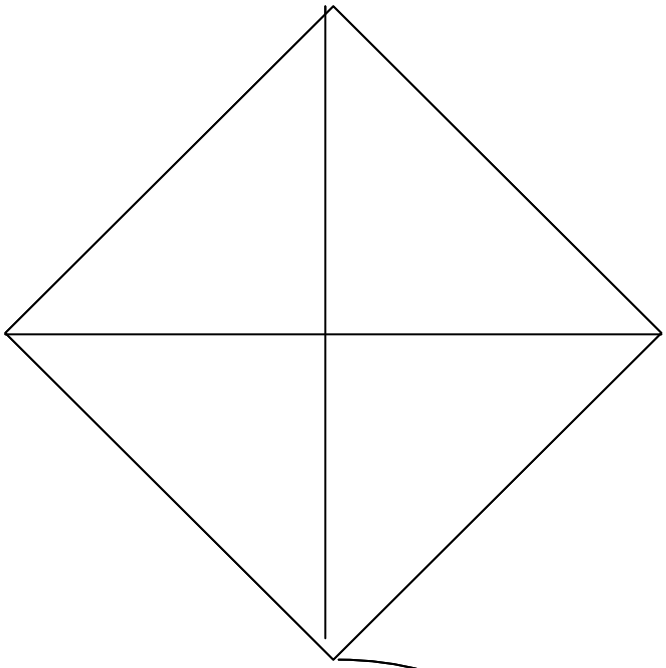
Label

Scale

Axis

Axis

Information



T- Title
A- Axis
I- Information

L- Label
S- Scale

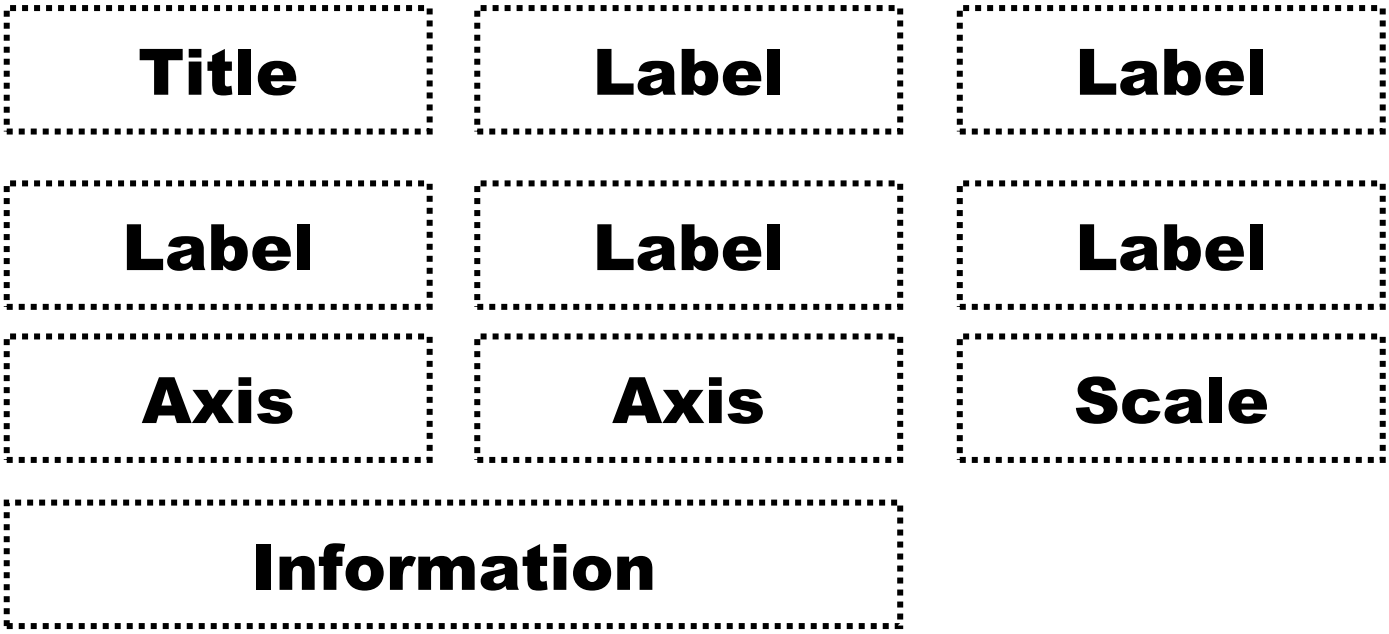
Title
a general description about a subject

Axis Either of two lines drawn perpendicular to each other in a graph

Information
a collection of facts or data

Label
Word used to identify something

Scale
a range of numbers on an axis

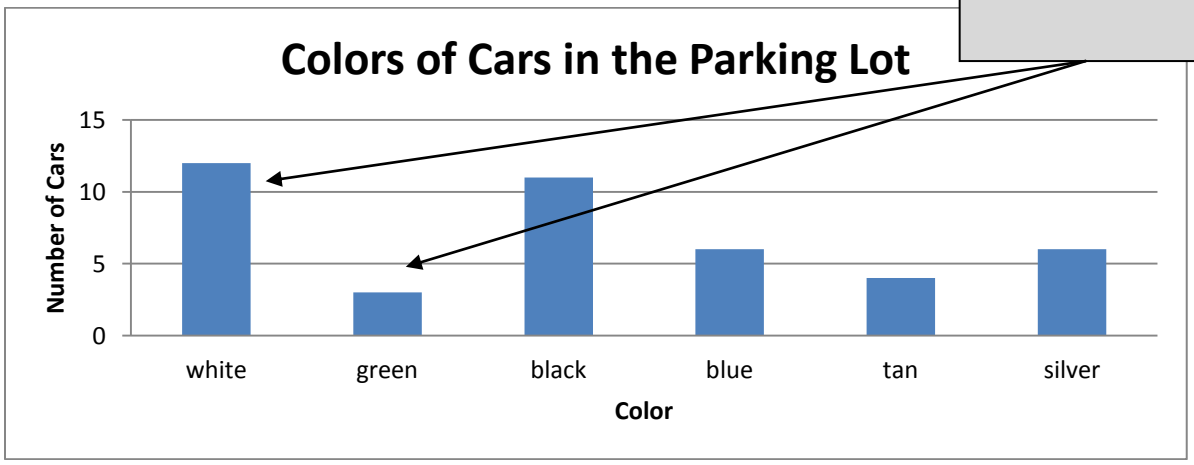

Title
Label
Label
Label
Label
Label
Axis
Axis
Scale
Information

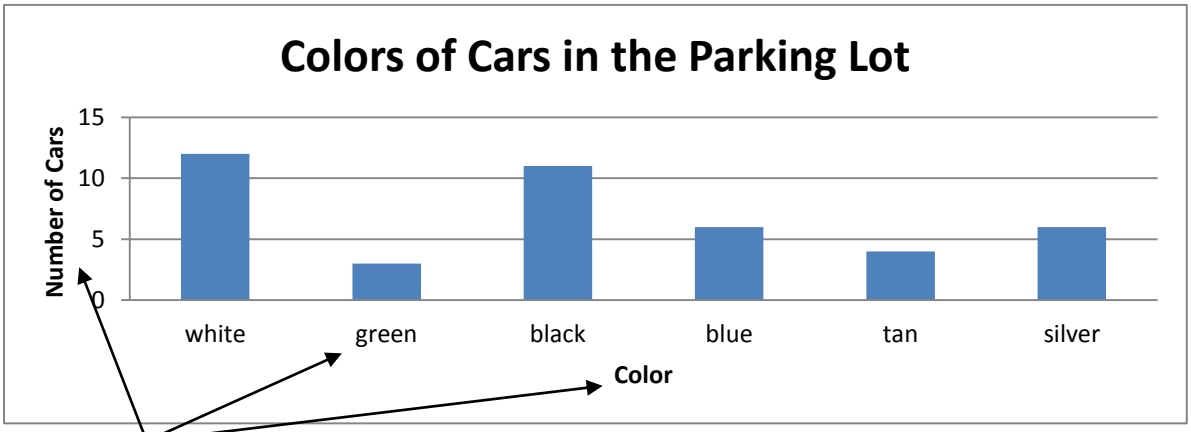
STUDENT LABELING ASSESSMENT

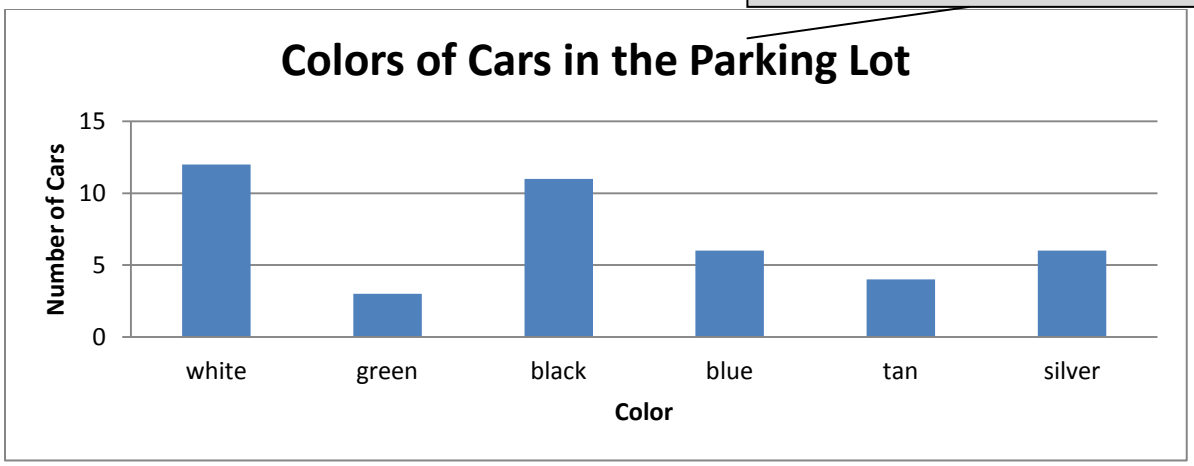
Name_____

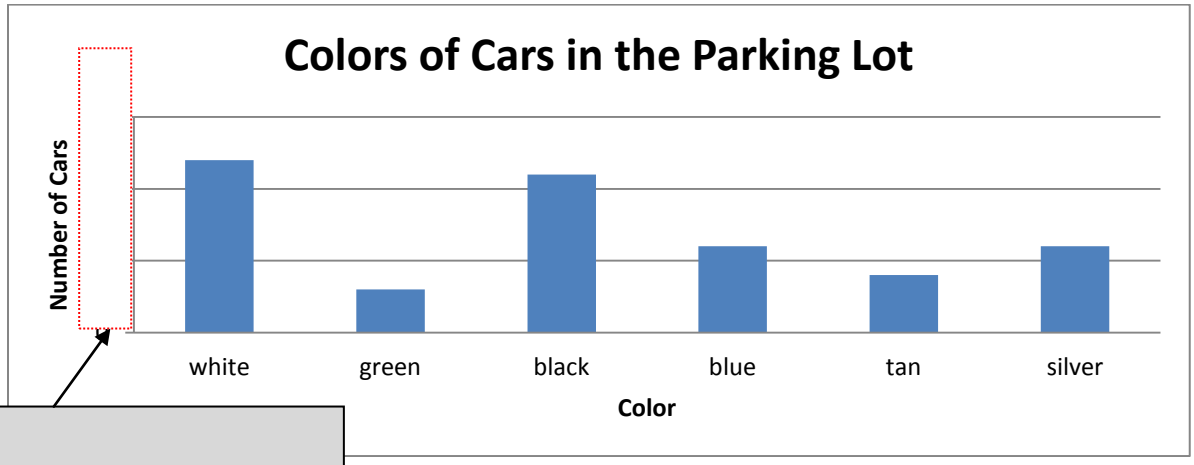
Use the word bank below to label the parts of a graph. Write your answer in the boxes provided.

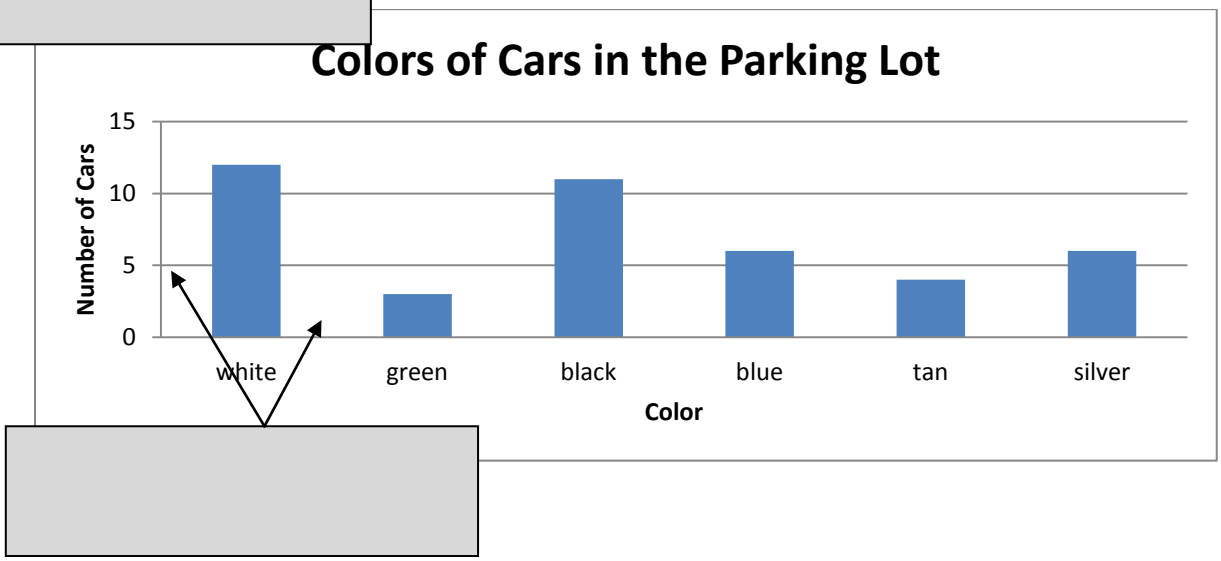
title	axis	information
label	scale	






Colors of Cars in the Parking Lot
Number of Cars
15
10
5
0
white
green
black
blue
tan
silver
Color

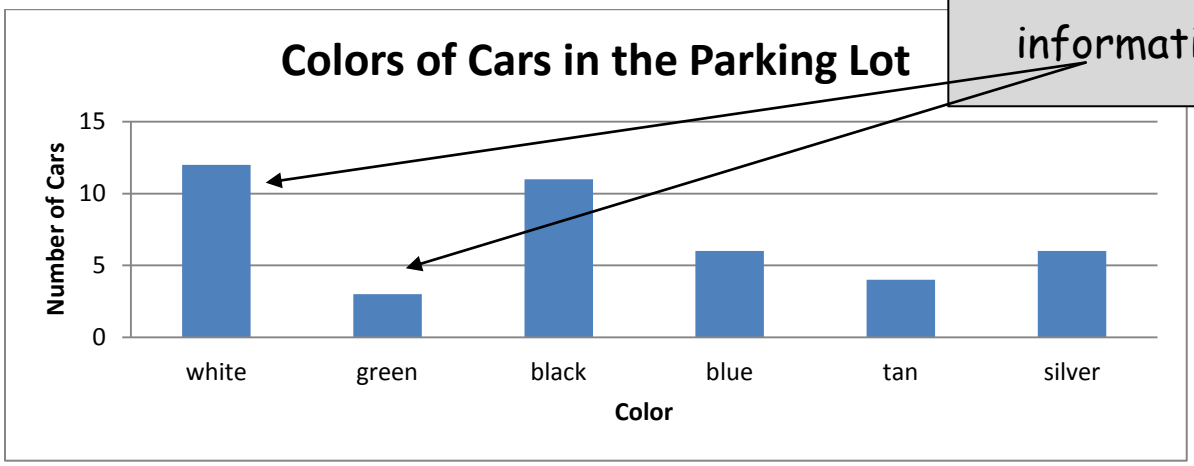

Colors of Cars in the Parking Lot
Number of Cars
white
green
black
blue
tan
silver
Color


Colors of Cars in the Parking Lot
Number of Cars
15
10
5
0
white
green
black
blue
tan
silver
Color

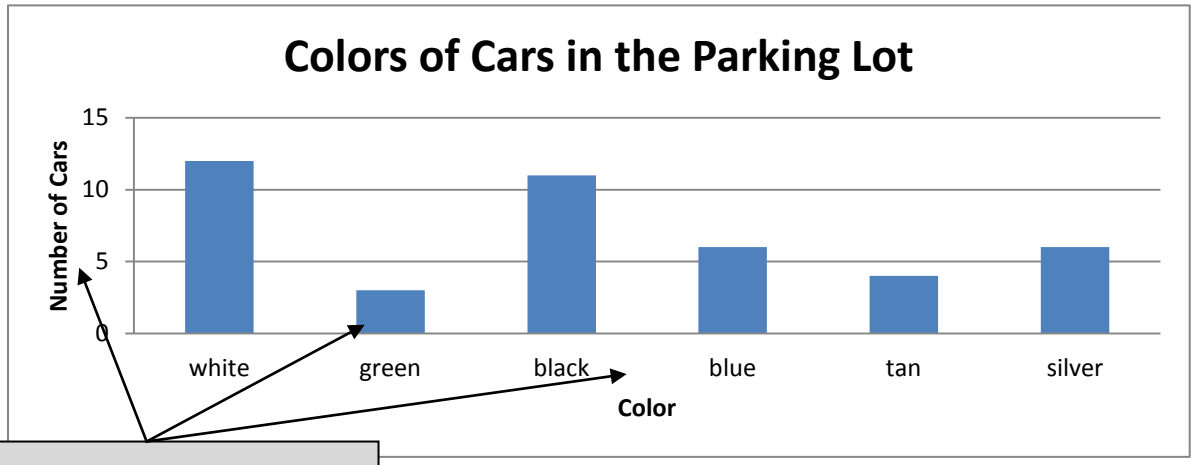
Name_____Teacher _____

Use the word bank below to label the parts of a graph. Write your answer in the boxes provided.

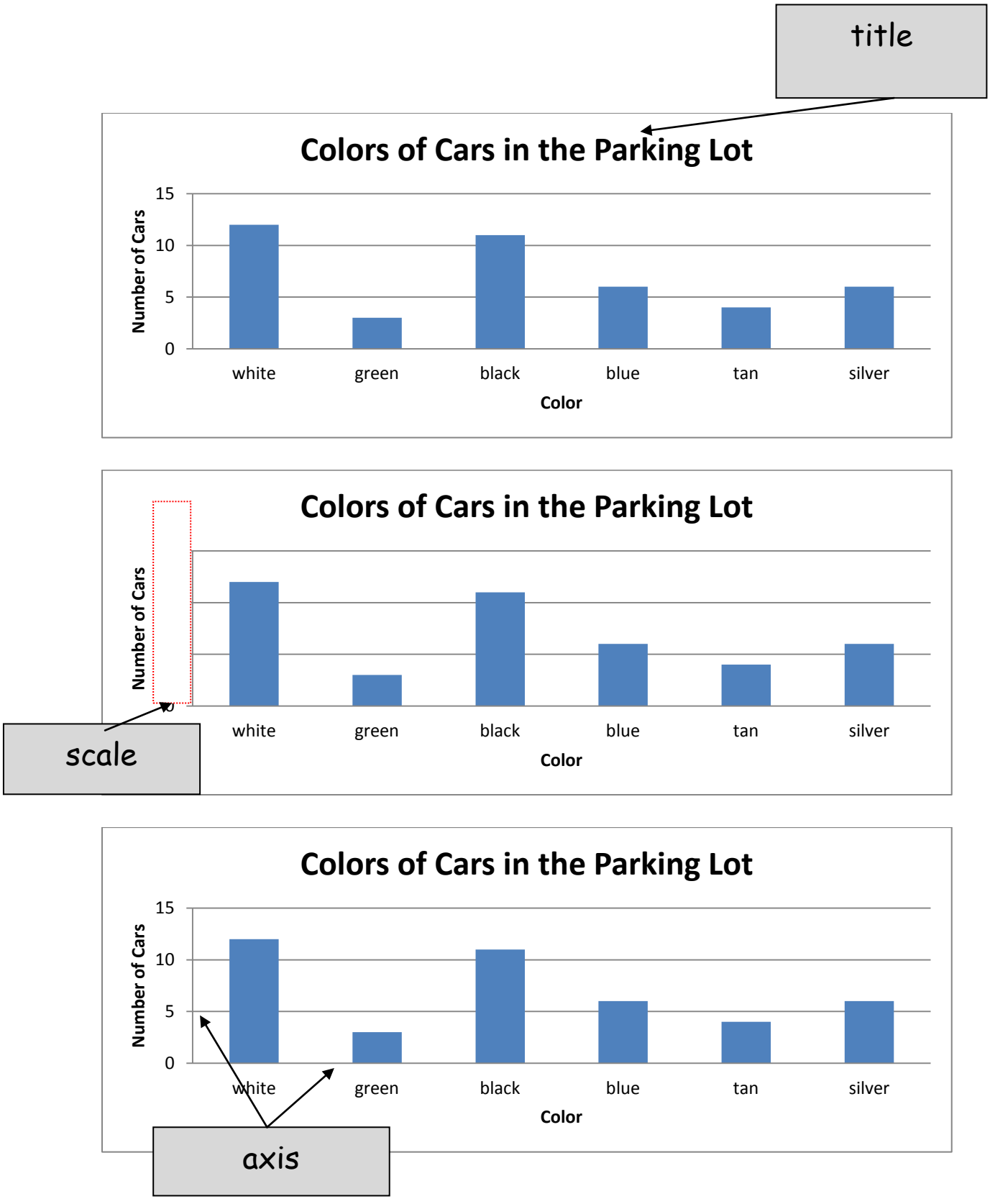
title	axis	information
label		scale

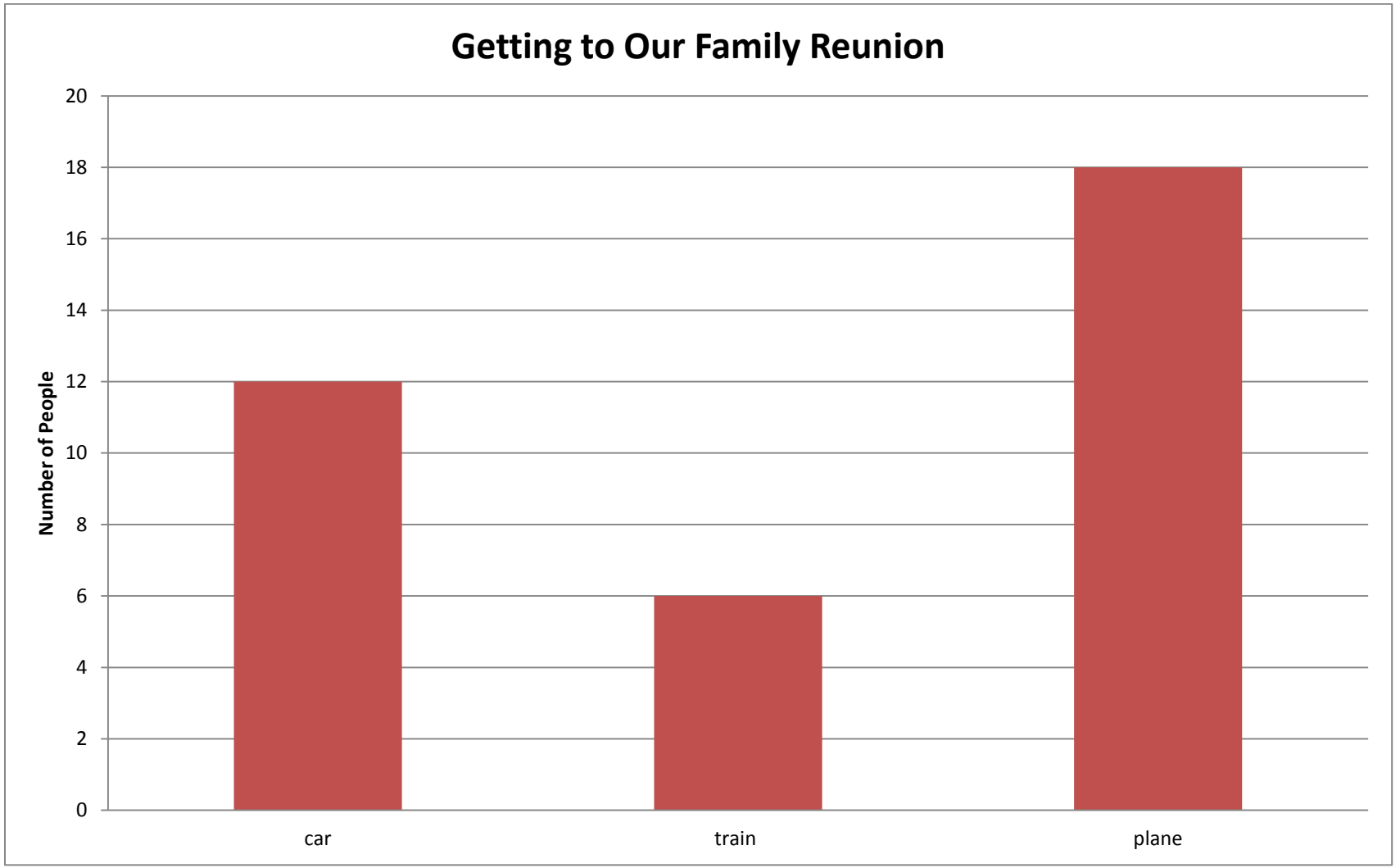


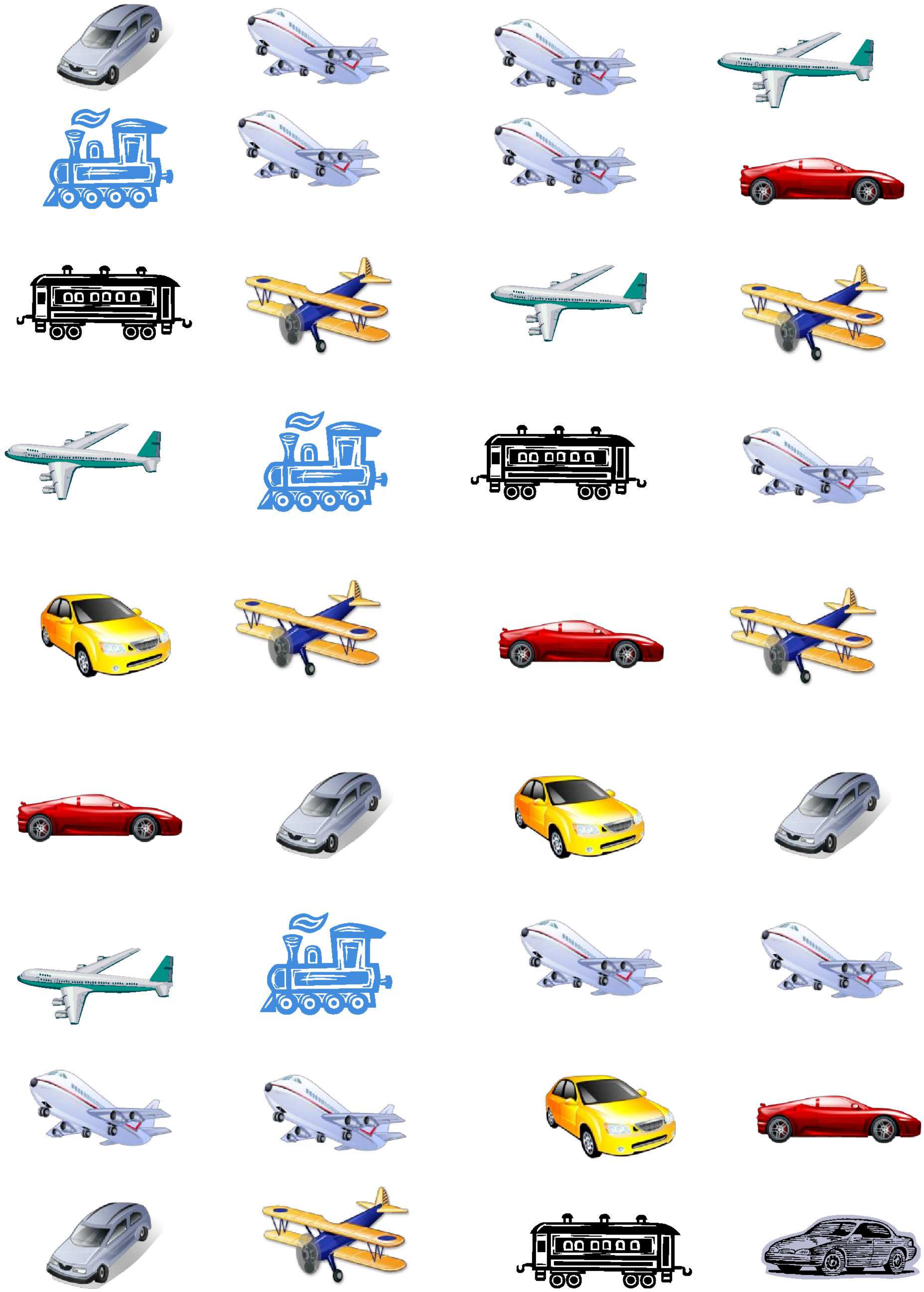
information



label


title
Colors of Cars in the Parking Lot
Number of Cars
15
10
5
0
white
green
black
blue
tan
silver
Color
Colors of Cars in the Parking Lot
Number of Cars
0
white
green
black
blue
tan
silver
Color
scale
Colors of Cars in the Parking Lot
Number of Cars
15
10
5
0
white
green
black
blue
tan
silver
Color
axis

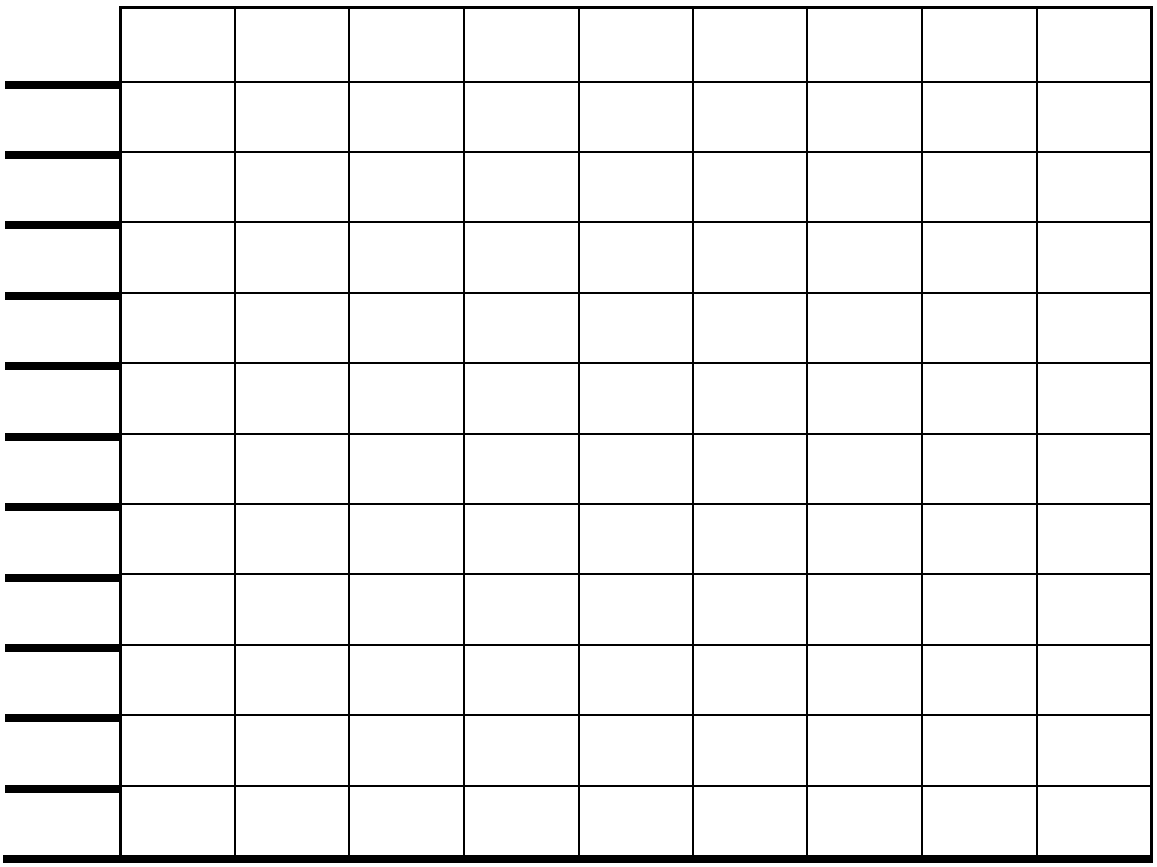

Getting to Our Family Reunion
Number of People
20
18
16
14
12
10
8
6
4
2
0
car
train
plane
Type of Transportation



STUDENT TRANSPORTATION BAG COOPERATIVE GRAPH WORK

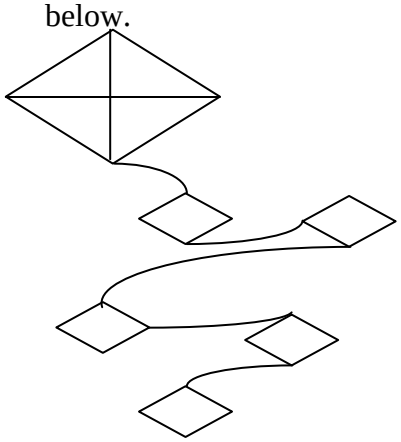
Name_____

Directions: Pull the types of transportation out of the bag, sort them, and organize the data in the graph below. Don't forget to self-check!



_____ _____ _____

Self Check- Check for each part of your graph and place a check mark in the boxes below.

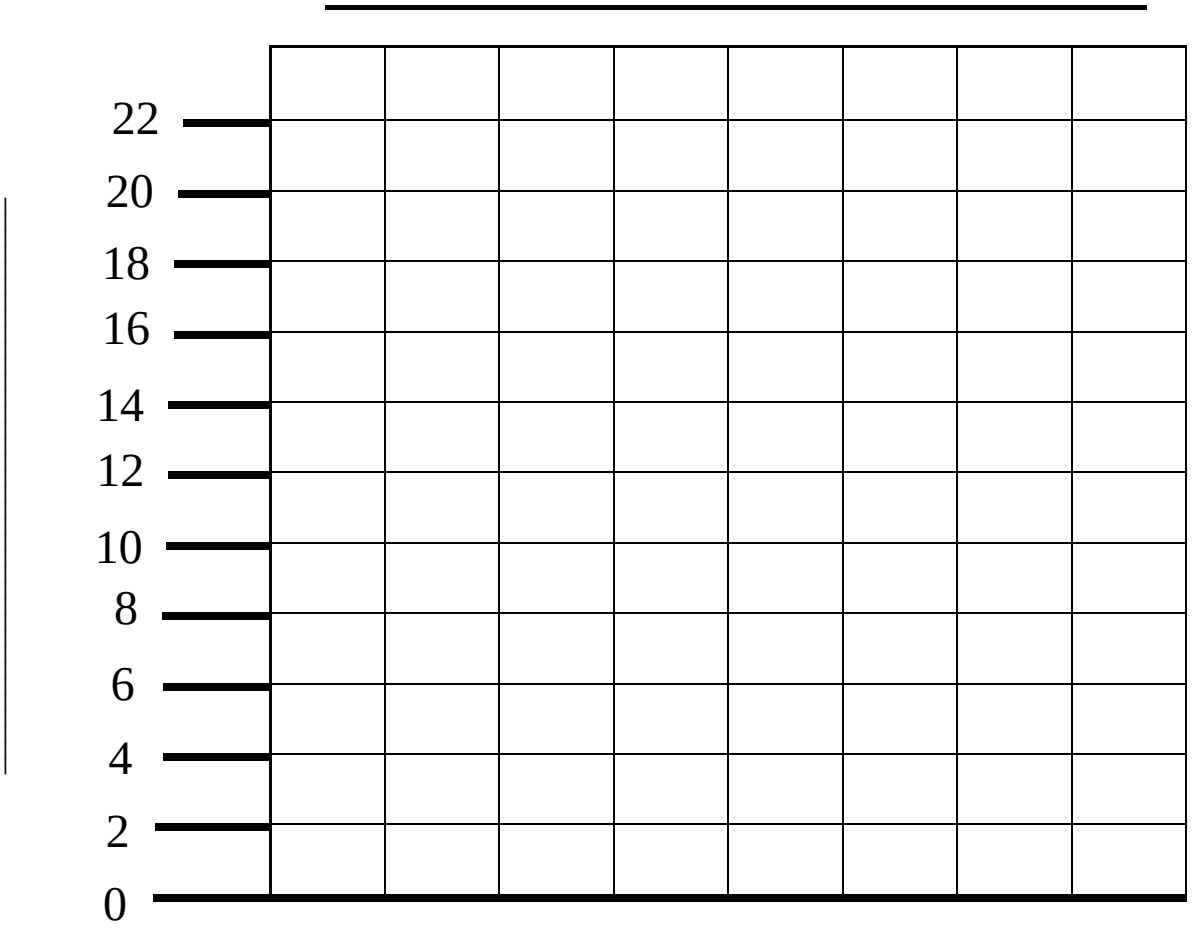


Title ☐
Axis ☐
Information ☐
Labels ☐
Scale ☐

STUDENT TRANSPORTATION BAG COOPERATIVE GRAPH WORK MODIFIED

Name_____

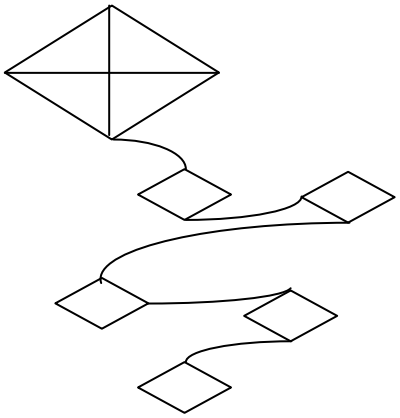
Directions: Pull the types of transportation out of the bag, sort them, and organize the data in the graph below. Don't forget to self-check!



_____ _____ _____

_____

Self Check- Check for each part of your graph and place a check mark in the boxes below.



Title ☐
Axis ☐
Information ☐
Labels ☐

Number of Vehicles

Type of Transportation

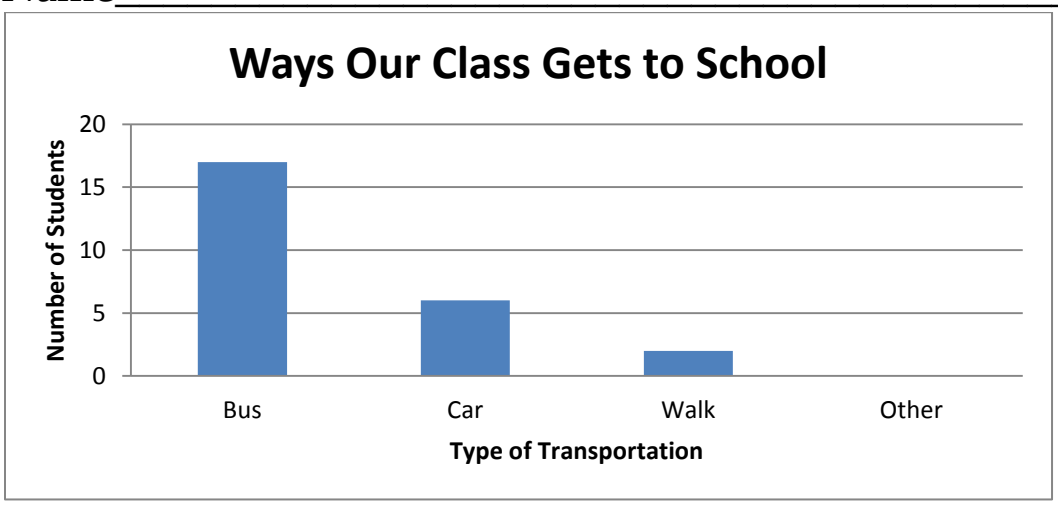
Car

Airplane

Train

Bag of Mystery Vehicles

Name_____



Directions: Look at the graph, Ways Our Class Gets to School, to answer the questions.

1. How did most of the students come to school?

   _____

2. How many more students rode the bus than walked to school?

   _____

3. Where do you think the students live?
   a. The city
   b. The country

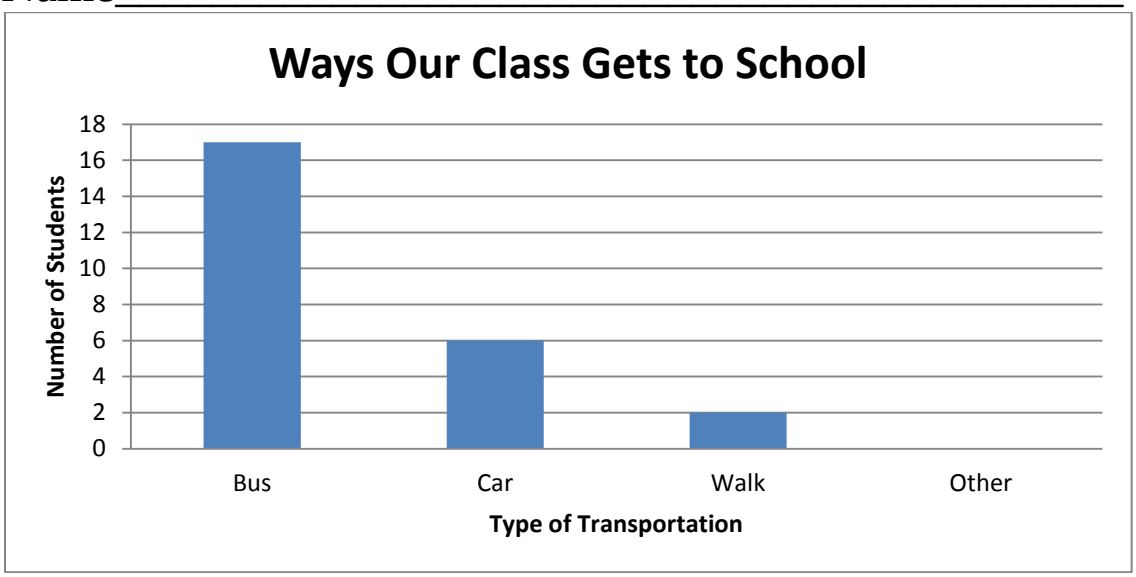
Explain why you think your answer is correct.

_____

_____

_____

Name_____



Directions: Look at the graph, Ways Our Class Gets to School, to answer the questions.

1. How did most of the students come to school?

   _____Bus_____

2. How many more students rode the bus than walked to school?

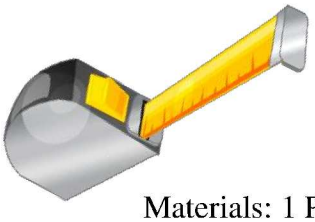
   _____15_____

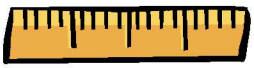
3. Where do you think the students live?
   c. The city
   d. The country

Explain why you think your answer is correct.

I think the students at this school live in the country because most of them arrive to school by bus or car. In the country people live far apart, therefore people live miles away from school making difficult to walk or ride a bike. I conclude that this graph is from a school in the country because the best way to get to school in the country is by bus or car.

Name *Teacher Sample*





Data Sheet

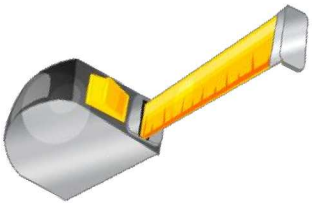
Materials: 1 Pull back car, a ruler, measuring tape, and a clipboard

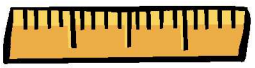
Directions:

1. Place the ruler onto the surface.
2. Put the pull back car at the 1 inch mark of the ruler and then pull it back to the 12 inch end and let the car go.
3. Use the measuring tape to measure from the end 12 inch part of the ruler to where the car stopped moving.
4. Record your results in the table below.
5. Continue steps 1-4 for all 3 surfaces.

Surface	Amount Car Travelled (Inches)
Carpet	*35 inches*
Tile	*38 inches*
Asphalt/Blacktop	*14 inches*

Name_____





Data Sheet

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Directions:

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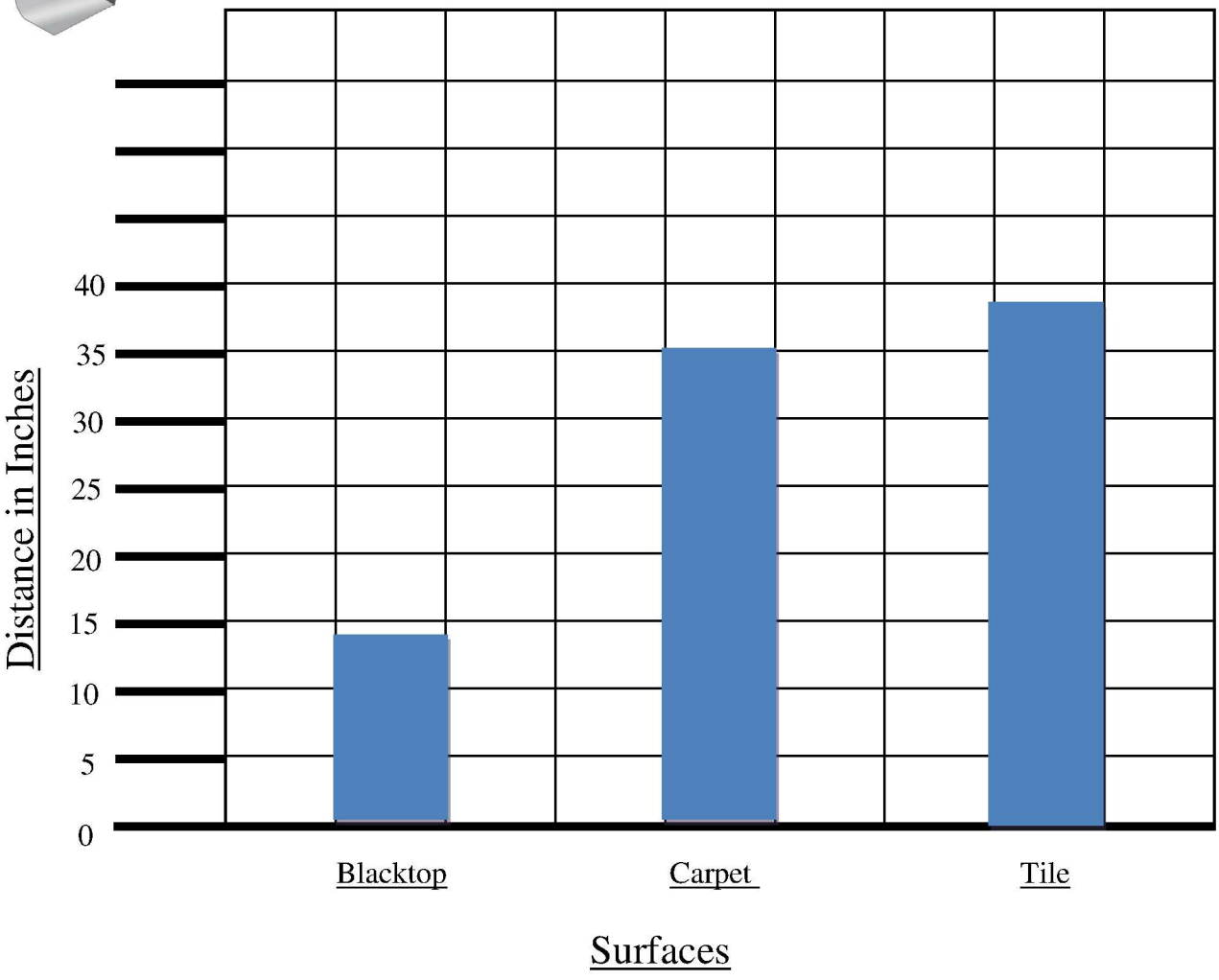
2. Put the pull back car at the 1 inch mark of the ruler and then pull it back to the 12 inch end and let the car go.
3. Use the measuring tape to measure from the end 12 inch part of the ruler to where the car stopped moving.
4. Record your results in the table below.
5. Continue steps 1-4 for all 3 surfaces.

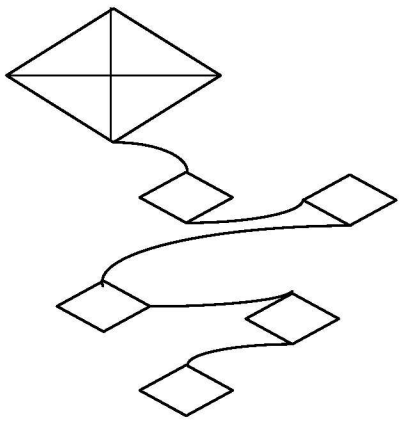
Surface	Amount Car Travelled (Inches)

Name *Teacher Sample / Teacher Data Sheet Graph*

Distance Car Travels on Different Surfaces



Self Check- Check for each part of your graph and place a check mark in the boxes below.

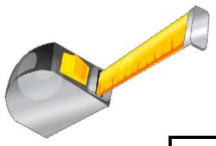


Title ☐
Axis ☐
Information ☐
Labels ☐
Scale ☐

STUDENT DATA SHEET GRAPH

Name_____

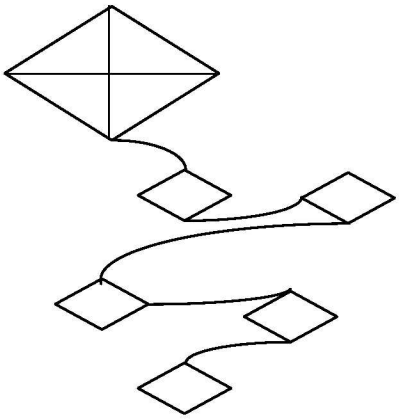
Directions: Use the data you collected to construct a bar graph below.



_____ _____ _____

_____

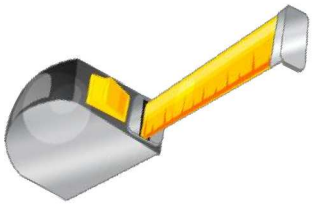
Self Check- Check for each part of your graph and place a check mark in the boxes below.

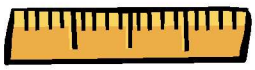


Title ☐
Axis ☐
Information ☐
Labels ☐
Scale ☐

DIFFERENTIATION

Name_____





Data Sheet

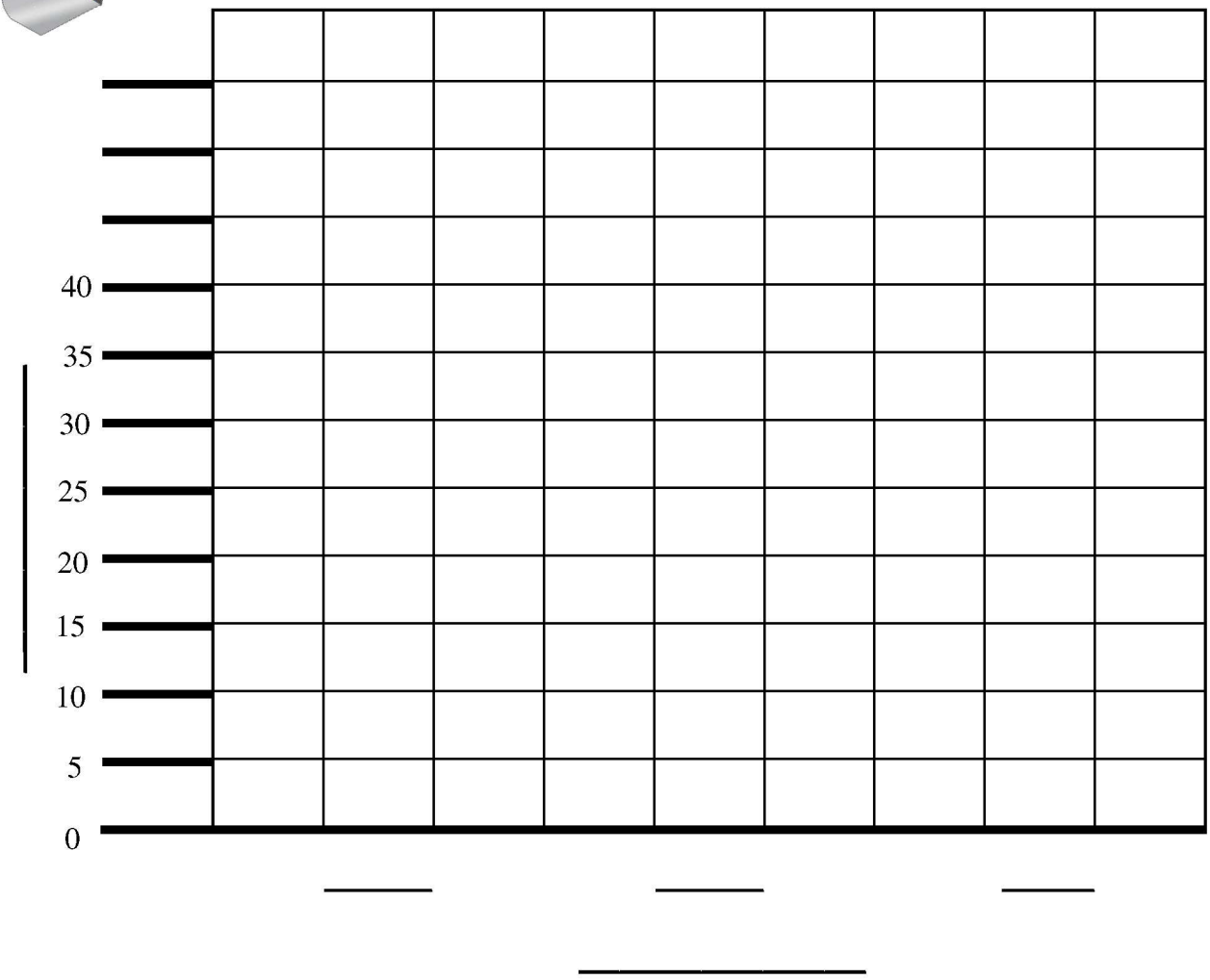
Materials: 1 Pull back car, a ruler, measuring tape, and a clipboard
Directions:

1. Place the ruler onto the surface.
2. Put the pull back car at the 1 inch mark of the ruler then pull it back to the 12 inch end and let the car go.
3. Use the measuring tape to measure from the end 12 inch part of the ruler to where the car went.
4. Record your results in the table below.
5. Continue steps 1-4 for all 3 surfaces.

Surface	Amount Car Travelled (Inches)
Ice	*39 inches*
Sand	*12 inches*
Rubber	*23 inches*

Name _____

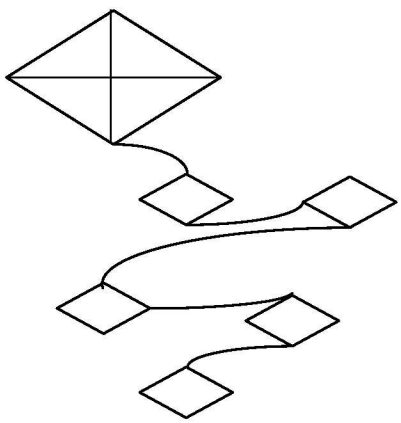
_____



_____ _____ _____

_____

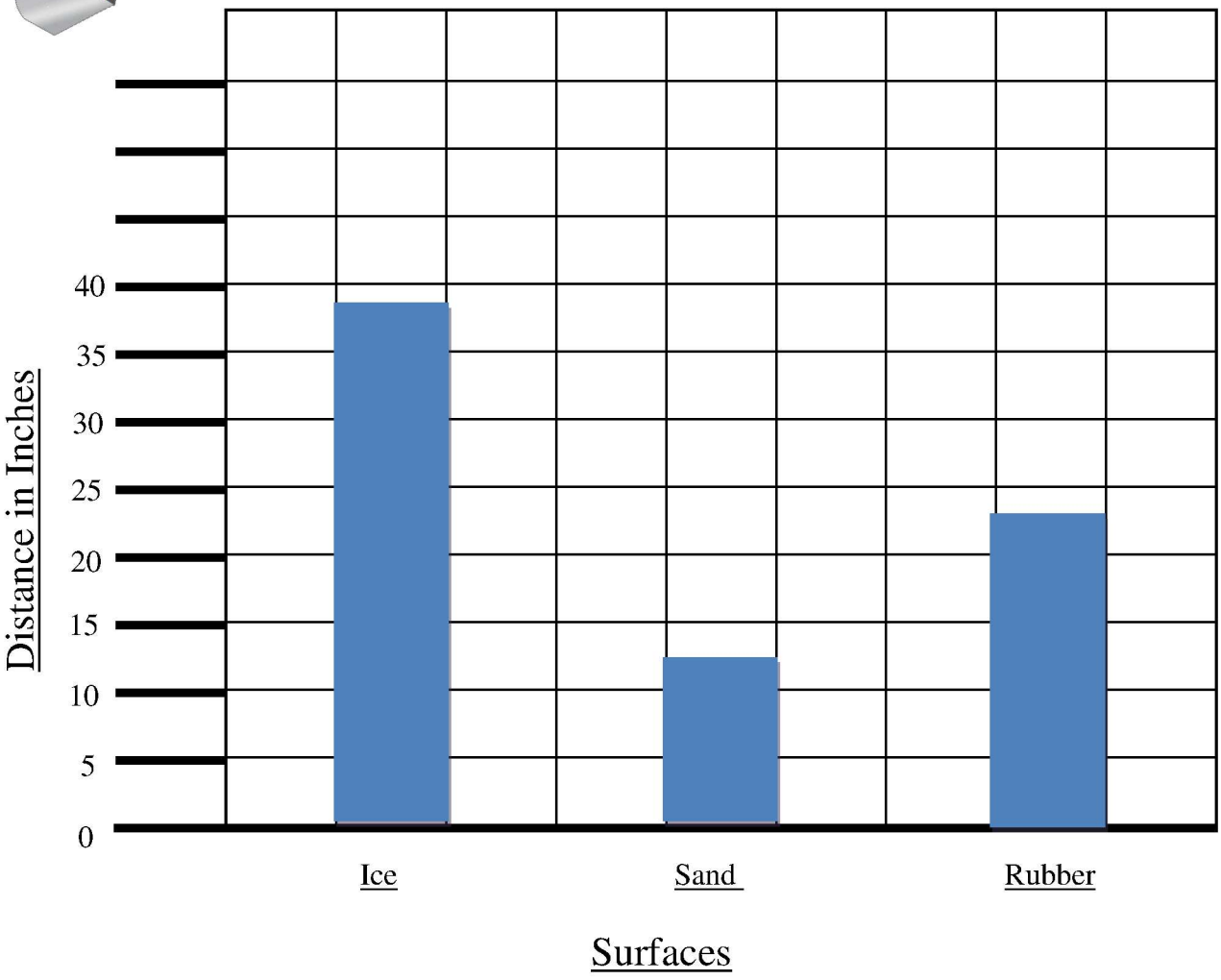
Self Check- Check for each part of your graph and place a check mark in the boxes below.



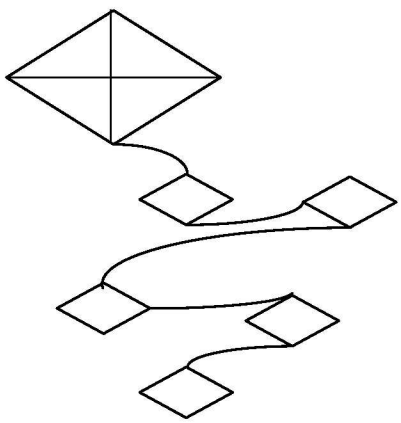
Title ☐
Axis ☐
Information ☐
Labels ☐
Scale ☐

Name *Teacher Sample*

Distance Car Travels on Different Surfaces



Self Check- Check for each part of your graph and place a check mark in the boxes below.



Title ☐
Axis ☐
Information ☐
Labels ☐
Scale ☐

STUDENT DATA SHEET ENRICH

Name_____

Data Sheet

Materials: 1 Pair of dice and a pencil

Directions:

1. Under Cars, write the name of your three favorite cars you would like to pretend to buy. Remember that the higher the miles per gallon a car has, the further you can drive it before needing to pay to fill it with gas.
2. For the first car, roll the dice, arrange each number in the ones and tens to create a digit which will be written down as the miles per gallon that specific car gets.
3. Complete step two for each car on the data table.
4. Using the information collected construct a bar graph on separate paper. Be sure to include TAILS (Title, Axis, Information, Labels, Scale).
5. Use the bar graph you created to answer the question at the bottom of this page.

Cars	Miles Per Gallon (MPG)

The BIG QUESTION!!! Use the information from the graph to tell which car you will buy and why. Draw a picture of the car on the back of this page._____

_____

_____

Summative Assessment

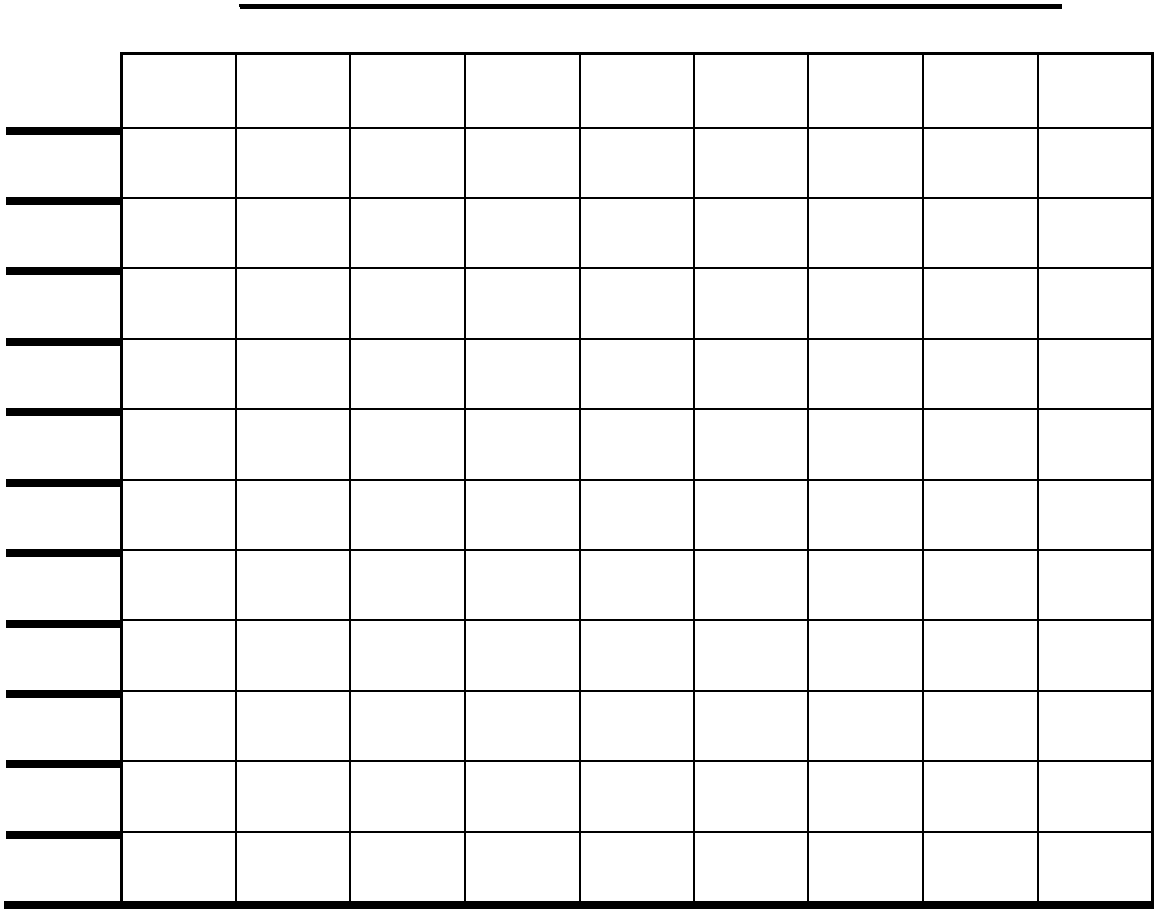
Name_____

The FASCAR races are so exciting! I wonder who is in the lead and winning right now. Use the table below to construct a bar graph on the next page. Your bar graph will detail who has gone the farthest or greatest amount of laps around the racetrack.

FASCAR drivers	Laps Completed
Busch	20
Edwards	5
Harvick	15

Name_____

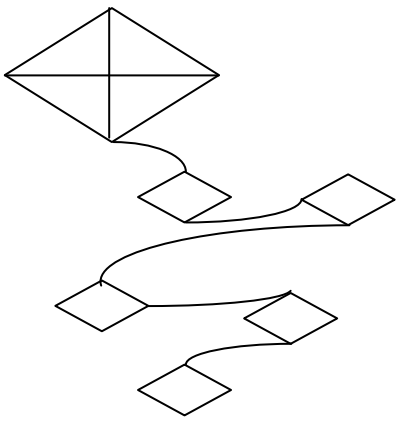
Directions: Use the data you collected to construct a bar graph below.



_____ _____ _____

_____

Self Check- Check for each part of your graph and place a check mark in the boxes below.



Title ☐
Axis ☐
Information ☐
Labels ☐
Scale ☐

Directions: Use the graph you made to answer the questions below.

1. **Which racer has completed the <u>least</u> amount of laps? Circle your answer.**
   a. **Busch**
   b. **Edwards**
   c. **Harvick**

2. **Which racer has completed the <u>greatest</u> amount of laps? Circle your answer.**
   d. **Busch**
   e. **Edwards**
   f. **Harvick**

3. **<u>How many more</u> laps has Harvick completed than Edwards? Circle your answer.**
   a. **15**
   b. **10**
   c. **5**

4. **Write an equation in the box below about your graph using <, >, or =. (Example: Trains > Cars)**

_____ _____ _____

5. **How many more laps could Harvick have**

_____

_____

_____

Summative Assessment

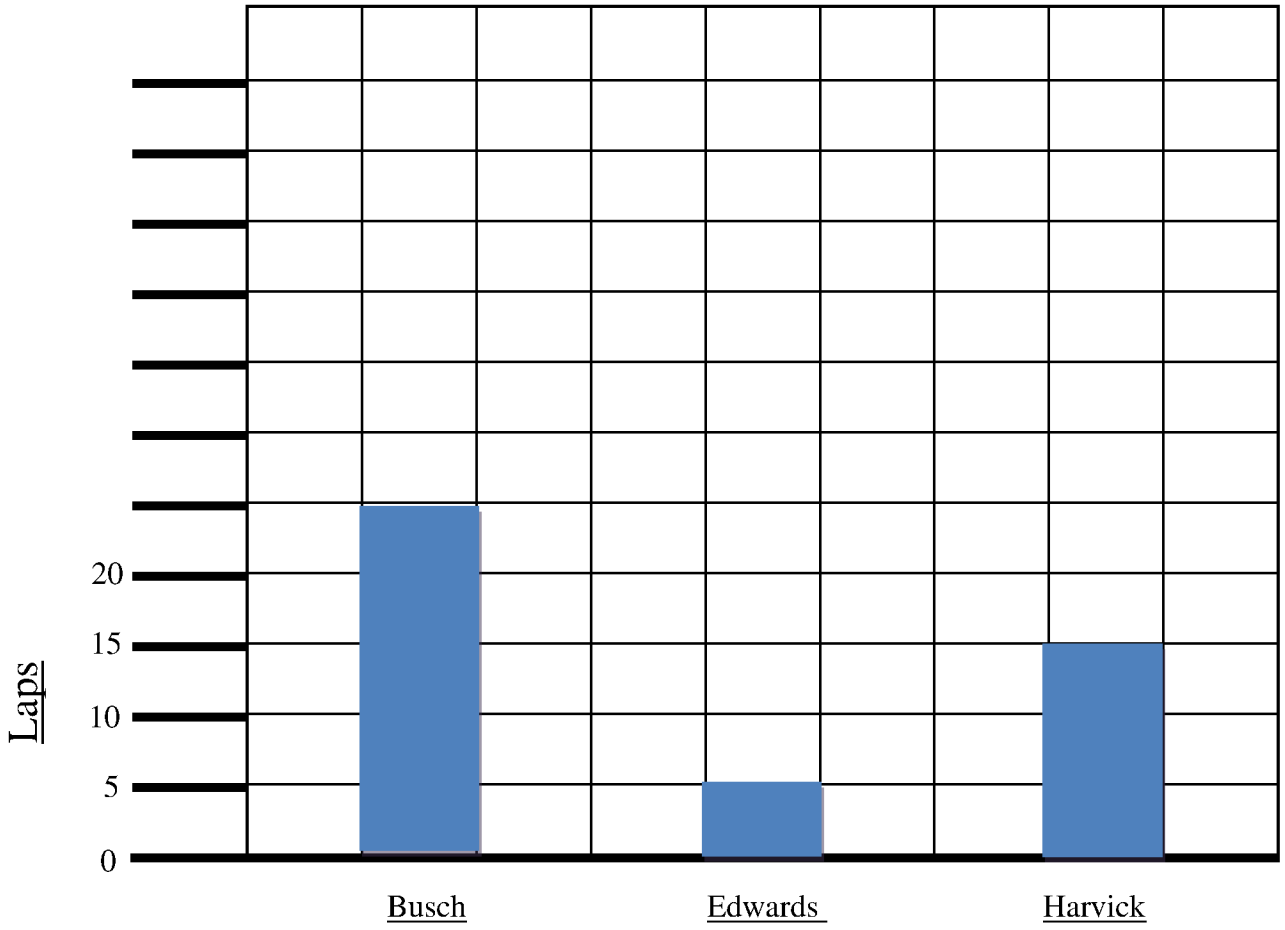
Teacher's Key

The FASCAR races are so exciting! I wonder who is in the lead and winning right now. Use the table below to construct a bar graph on the next page. Your bar graph will detail who has gone the farthest or greatest amount of laps around the racetrack.

FASCAR drivers	Laps Completed
Busch	20
Edwards	5
Harvick	15

Name *Teacher Sample*

(Answers May Vary)



FASCAR Racers

Self Check- Check for each part of your graph and place a check mark in the boxes below.

Title ☐
Axis ☐
Information ☐
Labels ☐
Scale ☐

Directions: Use the graph you made to answer the questions below.

1. **Which racer has completed the <u>least</u> amount of laps? Circle your answer.**
   - **g. Busch**
   - **h. Edwards**
   - **i. Harvick**

2. **Which racer has completed the <u>greatest</u> amount of laps? Circle your answer.**
   - **j. Busch**
   - **k. Edwards**
   - **l. Harvick**

3. **<u>How many more</u> laps has Harvick completed than Edwards? Circle your answer.**
   - **d. 15**
   - **e. 10**
   - **f. 5**

4. **Write an equation in the box below about your graph using <, >, or =. (Example: Trains > Cars)**

Answers Will Vary
_____ _____ _____

5. **How many more laps would Harvick have had to equal the amount of laps Busch completed? Explain how you got your answer.**

<u>Anwers will vary. Harvick would have needed to complete 5 more laps. I got this answer by subtracting Busch's amount of 20 laps by Harvick's amount of 15 laps which came to a total of 5 laps.</u>